

Application No. 09/921,458
Reply to Office Action of Dec. 29, 2004
Suppl. Amdt. dated Apr. 14, 2005

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.
Please amend Claim 40 as follows:

1-39. (Canceled)

40. (Previously Presented) An arrangement for serving information requests, comprising:

5 a plurality of information servers connected to a communications network, all of the information servers having a common address on the communications network and serving a set of information to clients, each of the information servers being configured to receive a transaction request associated with an individual transaction and to provide a response to each transaction request; and

10 a content director connecting the information servers to the communications network and distributing transaction requests among the information servers comprising:

a flow switch that selects an appropriate information server to service each transaction request and thereafter forwards at least portions of the transaction request to a selected one of the information servers;

15 a cache that stores, in a hot invariant table, a plurality of objects corresponding to at least some of the transaction requests forwarded to one or more of the information servers, the hot invariant table identifying information frequently requested from the information servers and including, for each invariant identifying corresponding information, a hit counter indicating a number of transaction requests, received over a determined time interval, requesting the corresponding information;

20 a cache processor that accesses the plurality of objects in response to communications received from the flow switch;

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a digest generator that generates, when the hit counter for an invariant indicates at least a threshold transaction request receipt frequency, a digest value pointing to the location in the hot invariant table where the corresponding entry is stored; and

25 a digest store that stores the digests corresponding to frequently requested content.

41. (Previously Presented) The arrangement of claim 40, wherein the flow switch parses plain text transaction requests to locate selected fields and wherein the content director further comprises:

5 a cryptographic module that decrypts, prior to parsing and information server selection by the flow switch, cipher text transaction requests and provides plain text transaction requests to the flow switch, wherein, prior to decryption, the cipher text transaction requests have not been routed by another flow switch.

42. (Previously Presented) The arrangement of claim 41, wherein, first and second encrypted transaction requests are received from different clients having a common electronic address and served substantially simultaneously by different information servers, wherein at least some of the responses include a cookie, wherein the cookie is generated by the
5 information server previously assigned by the flow switch to service transaction requests from the client, and wherein the flow switch uses at least one of an invariant, a cookie, and a tag in the parsed plain text equivalent of each transaction request to select an appropriate information server to service each of the first and second transaction requests.

43. (Previously Presented) The arrangement of claim 40, wherein each invariant in the hot invariant table further has a corresponding timestamp indicating when the respective entry was last updated, and a tag identifying a corresponding information server providing the corresponding information.

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44. (Previously Presented) The arrangement of claim 40, wherein the digest store includes a digest value for each frequently requested invariant.

45. (Previously Presented) The arrangement of claim 40, wherein, when the hit counter for an invariant indicates at least a threshold transaction request receipt frequency, the information corresponding to the invariant is served by a cache information server and not an origin information server.

46. (Previously Presented) The arrangement of claim 45, wherein, when the hit counter for an invariant falls below a threshold transaction request receipt frequency, the information corresponding to the invariant is served by an origin information server and not a cache information server.

47. (Previously Presented) The arrangement of claim 40, wherein the digest value is determined according to the following equation:

$L = h(K)$, where $0 \leq L \leq M$, for all keys K , where K is at least a portion of the invariant, h is the hash function, L is the location of K in the hot invariant table, and M is the size of the hot invariant table.

48. (Previously Presented) The arrangement of claim 40, further comprising:
at least one traffic manager located between the content director and one or more clients to effect load balancing across a plurality of content directors.

49. (Previously Presented) The arrangement of claim 40, wherein the content director includes a current connection table listing active connections between servers and clients, the current connection table comprising, for a selected invariant, a session identifier identifying a session with a client, a persistency timestamp indicating when a last transaction

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- 5 request was received from the respective client for the selected invariant, and cookie name and value.

50. (Previously Presented) The arrangement of claim 40, wherein the flow switch is operable to tag a transaction response, the tag identifying an information server generating the transaction response.

51. (Previously Presented) The arrangement of claim 50, wherein at least some of the responses include a cookie, wherein the cookie is generated by the information server previously assigned by the flow switch to service transaction requests from the client, and wherein the cookie is different from the tag.

52. (Previously Presented) The arrangement of claim 51, wherein the tag is concatenated to the cookie.

53. (Previously Presented) The arrangement of claim 52, wherein, during a first time interval, the flow switch is in a tagging mode in which the switch generates and appends tags to transaction responses and, during a second different time interval, the switch operates in a digesting mode in which digests are generated, invariant hotness is monitored, and transaction requests are routed to information servers based on requested invariant hotness and/or cookie.

54. (Previously Presented) In an arrangement comprising a plurality of information servers connected to a communications network, each of the information servers being configured to receive a transaction request associated with an individual transaction and to provide a response to each transaction request, a method for serving transaction requests from clients comprising:

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maintaining a hot invariant table identifying information frequently requested from the information servers, the hot invariant table including, for each invariant identifying corresponding information, a hit counter indicating a number of transaction requests, received over a determined time interval, requesting the corresponding information;

10 generating, when the hit counter for a selected invariant indicates at least a threshold transaction request receipt frequency, a digest value pointing to the location in the hot invariant table where the entry corresponding to the selected invariant is stored; and

accessing a digest store comprising the digest values to select an information server to service a transaction request for frequently requested information.

55. (Previously Presented) The method of claim 54, wherein all of the information servers have a common address on the communications network and serve a set of information to clients and further comprising:

5 a cryptographic module decrypting a cipher text transaction request to provide a plain text transaction request to a first flow switch;

the first flow switch parsing the plain text transaction request to locate one or more selected fields;

the first flow switch, based on the one or more selected fields, selecting an appropriate information server to service the transaction request; and

10 the first flow switch thereafter forwarding at least portions of the plain text transaction request to a selected one of the information servers, wherein the cipher text transaction request is decrypted prior to the parsing and selecting steps and wherein, prior to the decrypting step, the cipher text transaction request has not been directed to a flow switch other than the first flow switch.

56. (Previously Presented) The method of claim 55, further comprising:

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5 receiving first and second encrypted transaction requests from different clients having a common electronic address, the requests being served substantially simultaneously by different information servers, wherein at least some of the responses include a cookie, wherein the cookie is generated by the information server previously assigned by the first flow switch to service transaction requests from the client, and wherein the first flow switch uses at least one of an invariant, a cookie, and a tag in the parsed plain text equivalent of each transaction request to select an appropriate information server to service each of the first and second transaction requests

57. (Previously Presented) The method of claim 54, wherein each invariant in the hot invariant table further has a corresponding timestamp indicating when the respective entry was last updated, and a tag identifying a corresponding information server providing the corresponding information.

58. (Previously Presented) The method of claim 54, wherein a digest value is generated for each frequently requested invariant.

59. (Previously Presented) The method of claim 58, further comprising:
when the hit counter for an invariant indicates at least a threshold transaction request receipt frequency, directing a transaction request for information associated with the invariant to a cache information server.

60. (Previously Presented) The method of claim 59, further comprising:
when the hit counter for an invariant falls below a threshold transaction request receipt frequency, directing a transaction request for information associated with the invariant to an origin information server.

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61. (Previously Presented) The method of claim 54, wherein the digest value is determined according to the following equation:

$L = h(K)$, where $0 \leq L \leq M$, for all keys K , where K is at least a portion of the invariant, h is the hash function, L is the location of K in the hot invariant table, and M is the size of the hot invariant table.

62. (Previously Presented) The method of claim 54, wherein at least one traffic manager is located between the content director and one or more clients to effect load balancing across a plurality of content directors.

63. (Previously Presented) The method of claim 54, further comprising:
maintaining a current connection table listing active connections between servers and clients, the current connection table comprising, for a selected invariant, a session identifier identifying a session with a client, a persistency timestamp indicating when a last transaction request was received from the respective client for the selected invariant, and cookie name and value.

64. (Previously Presented) The method of claim 54, further comprising:
during a first time interval, the first flow switch tagging a transaction response, the tag identifying an information server generating the transaction response.

65. (Previously Presented) The method of claim 64, wherein at least some of the responses include a cookie, wherein the cookie is generated by the information server previously assigned by the first flow switch to service transaction requests from the client, and wherein the cookie is different from the tag.

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66. (Previously Presented) The method of claim 65, wherein the tag is concatenated to the cookie.

67. (Previously Presented) The method of claim 64, further comprising:
during a second different time interval, generating a digest value for frequently requested information, the digest value indicating a location where an object associated with the frequently requested information is stored;
5 monitoring the frequency of transaction requests for information; and
directing transaction requests to information servers based on the frequency of request of information and/or a cookie included in at least some of the transaction requests.

68. (Previously Presented) A computer readable medium comprising instructions to perform the steps of claim 54.

69. (Previously Presented) An arrangement for serving information requests, comprising:
a plurality of information servers connected to a communications network, all of the information servers having a common address on the communications network and serving
5 a set of information to clients, each of the information servers being configured to receive a transaction request associated with an individual transaction and to provide a response to each transaction request; and
content director means for connecting the information servers to the communications network and distributing transaction requests among the information servers comprising:
10 first flow switching means for parsing plain text transaction requests to locate selected fields, selecting an appropriate information server to service each transaction request, and thereafter forwarding at least portions of the parsed transaction requests to a selected one of the information servers;

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15 cache means for storing, in a hot invariant table, a plurality of objects
corresponding to transaction requests forwarded to one or more of the information servers,
the hot invariant table identifying information frequently requested from the information
servers and including, for each invariant identifying corresponding information, a hit counter
indicating a number of transaction requests, received over a determined time interval,
requesting the corresponding information;

20 cache processing means for accessing the plurality of objects in response to
communications received from the first flow switching means;

digest generator means for generating, when the hit counter for an invariant
indicates at least a threshold transaction request receipt frequency, a digest value pointing to
the location in the hot invariant table where the corresponding entry is stored; and

25 digest store means for storing the digests corresponding to frequently
requested content.

70. (Previously Presented) The arrangement of claim 69, wherein the content
director means further comprises:

5 decrypting means for decrypting, prior to parsing and information server selection by
the first flow switching means, cipher text transaction requests and providing plain text
transaction requests to the first flow switching means, wherein, prior to the decrypting
function, the cipher text transaction request has not been directed to a flow switching means
other than the first flow switching means.

71. (Previously Presented) The arrangement of claim 70, wherein, first and second
encrypted transaction requests are received from different clients having a common electronic
address and served substantially simultaneously by different information servers, wherein at
least some of the responses include a cookie, wherein the cookie is generated by the
5 information server previously assigned by the first flow switching means to service

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transaction requests from the client, and wherein the first flow switching means uses at least one of an invariant, a cookie, and a tag in the parsed plain text equivalent of each transaction request to select an appropriate information server to service each of the first and second transaction requests.

72. (Previously Presented) The arrangement of claim 69, wherein, when the hit counter for an invariant indicates at least a threshold transaction request receipt frequency, the information corresponding to the invariant is served by a cache information server and not an origin information server and wherein, when the hit counter for an invariant falls below a threshold transaction request receipt frequency, the information corresponding to the invariant is served by an origin information server and not a cache information server.

73. (Previously Presented) The arrangement of claim 69, wherein the digest value is determined according to the following equation:

$L = h(K)$, where $0 \leq L \leq M$, for all keys K , where K is at least a portion of the invariant, h is the hash function, L is the location of K in the hot invariant table, and M is the size of the hot invariant table.

74. (Previously Presented) The arrangement of claim 69, wherein the first flow switching means tags a transaction response, the tag identifying an information server generating the transaction response, wherein at least some of the responses include a cookie, wherein the cookie is generated by the information server previously assigned by the first flow switching means to service transaction requests from the client, wherein the cookie is different from the tag, and wherein the tag is concatenated to the cookie.

75. (Previously Presented) In an arrangement comprising a plurality of information servers connected to a communications network, each of the information servers being

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configured to receive a transaction request associated with an individual transaction and to provide a response to each transaction request, a method for serving transaction requests from clients comprising:

maintaining a hot invariant table identifying information frequently requested from the information servers, the hot invariant table including, for each invariant identifying corresponding information, a hit counter indicating a number of transaction requests, received over a determined time interval, requesting the corresponding information;

when the hit counter for an invariant indicates at least a threshold transaction request receipt frequency, locating the information associated with the invariant at a cache information server and thereafter directing a transaction request for information associated with the invariant to a cache information server; and

when the hit counter for an invariant falls below a threshold transaction request receipt frequency, directing a transaction request for information associated with the invariant to an origin information server.

76. (Previously Presented) The method of claim 75, wherein all of the information servers have a common address on the communications network and serve a set of information to clients and further comprising:

5 a cryptographic module decrypting a cipher text transaction request to provide a plain text transaction request to a first flow switch;

the first flow switch parsing the plain text transaction request to locate one or more selected fields;

the first flow switch, based on the one or more selected fields, selecting an appropriate information server to service the transaction request; and

10 the first flow switch thereafter forwarding at least portions of the plain text transaction request to a selected one of the information servers, wherein the cipher text transaction request is decrypted prior to the parsing and selecting steps and wherein, prior to the

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decrypting step, the cipher text transaction request has not been directed to a flow switch other than the first flow switch.

77. (Previously Presented) The method of claim 76, further comprising:

receiving first and second encrypted transaction requests from different clients having a common electronic address, the requests being served substantially simultaneously by different information servers, wherein at least some of the responses include a cookie, wherein the cookie is generated by the information server previously assigned by the first flow switch to service transaction requests from the client, and wherein the first flow switch uses at least one of an invariant, a cookie, and a tag in the parsed plain text equivalent of each transaction request to select an appropriate information server to service each of the first and second transaction requests

78. (Previously Presented) The method of claim 76, further comprising:

generating, when the hit counter for an invariant indicates at least a threshold transaction request receipt frequency, a digest value pointing to the location in the hot invariant table where the corresponding entry is stored; and

accessing the hot invariant table to select an information server to service a transaction request for frequently requested information.

79. (Previously Presented) The method of claim 78, wherein a digest value is generated for each frequently requested invariant.

80. (Previously Presented) The method of claim 75, wherein each invariant in the hot invariant table further has a corresponding timestamp indicating when the respective entry was last updated, and a tag identifying a corresponding information server providing the corresponding information.

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81. (Previously Presented) The method of claim 78, wherein the digest value is determined according to the following equation:

$L = h(K)$, where $0 \leq L \leq M$, for all keys K , where K is at least a portion of the invariant, h is the hash function, L is the location of K in the hot invariant table, and M is the size of the hot invariant table.

82. (Previously Presented) The method of claim 75, wherein at least one traffic manager is located between the content director and one or more clients to effect load balancing across a plurality of content directors.

83. (Previously Presented) The method of claim 75, further comprising:
maintaining a current connection table listing active connections between servers and clients, the current connection table comprising, for a selected invariant, a session identifier identifying a session with the respective client, a persistency timestamp indicating when a last transaction request was received from a client for the selected invariant, and cookie name and value.

84. (Previously Presented) The method of claim 75, further comprising:
during a first time interval, the first flow switch tagging a transaction response, the tag identifying an information server generating the transaction response.

85. (Previously Presented) The method of claim 84, wherein at least some of the responses include a cookie, wherein the cookie is generated by the information server previously assigned by the first flow switch to service transaction requests from the client, and wherein the cookie is different from the tag.

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86. (Previously Presented) The method of claim 85, wherein the tag is concatenated to the cookie.

87. (Previously Presented) The method of claim 84, further comprising:
during a second different time interval, generating a digest value for frequently requested information, the digest value indicating a location where an object associated with the frequently requested information is stored;

5 monitoring the frequency of transaction requests for information; and
directing transaction requests to information servers based on the frequency of request of information and/or a cookie included in at least some of the transaction requests.

88. (Previously Presented) A computer readable medium comprising instructions to perform the steps of claim 75.